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## SOME ALGAE FROM CLIPPERTON ISLAND AND THE DANGER ISLANDS


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BOX 482, R.F.D. 1 SOLVANG, CALIFORNIA

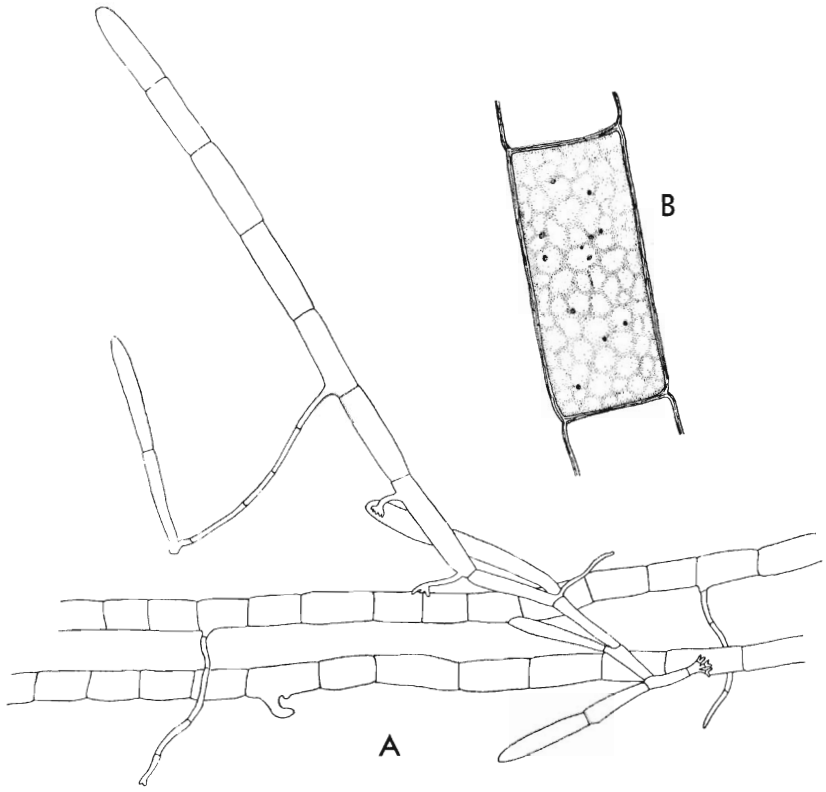


Fig. 1. *Rhizoclonium profundum* sp. nov., from the type collection. A, Habit of a young plant attached to two filaments of older plants, showing rhizoids, attachments and branches, × 20. B, Detail of a single mature cell showing stratified walls and reticulate chloroplast, × 75.

# SOME ALGAE FROM CLIPPERTON ISLAND AND THE DANGER ISLANDS

By E. YALE DAWSON

Through the cooperation of Dr. Carl L. Hubbs the writer has received through the Scripps Institution of Oceanography two interesting collections of tropical Pacific benthic algae, one from remote Clipperton Island, the easternmost coral atoll in the Pacific, and one from a depth of about 200 feet at Pukapuka in the Danger Islands, Union Group, about 400 miles northeast of Samoa. These are reported on below in turn. I am grateful to Dr. Isabella Abbott for reading and criticizing this paper.

## Clipperton Island

The algal vegetation of this solitary atoll is known only from the papers of Taylor (1939) and Dawson (1957). These reports list only 17 entities, including 6 species of Cyanophyta and 3 unsatisfactorily identified species of other groups. The present collections, made principally by Messrs. C. Limbaugh, T. Chess, A. Hambly and Miss M.-H. Sachet on the recent Scripps Institution Expedition (August-September, 1958), are more ample than any previously available, and permit us to add 30 marine species and 14 terrestrial and fresh water species, making a total of 61 known from the atoll. The marine collections were made from several different habitats around the island, as follows:[1]

19951-19954. N. E. transect at a depth of 30 feet, August 28
19955-19975. Reef-flat
19976-19977. Reef ridge on east side of island, Sept. 14
19977a-19984. Reef margin on east side of island, Aug. 29
19985 Beach drift on north side of island, Aug. 25
19986-19991. N. E. corner of island at a depth of 45 feet. Aug. 30
19993-19995. N. E. transect at a depth of 20 feet, Aug. 27
19996-19999. N. E. side of island at a depth of 45 feet, Aug. 28
20001-20008. N. E. transect at a depth of 78 feet, Aug. 27
20010-20020. Beach drift on N. E. side of island, Aug.
Sachet 306. Forming thin layer on beach rock, rocky pools on ocean side just S. E. of north point, Aug. 9
Sachet 462; 471. In surface sand at top of beach, N. E. side of island near landing, Aug. 8, 19

[1]The five-digit field numbers were assigned by the writer and represent specimens deposited in the herbaria of the University of California, the Scripps Institution and the National Museum at Paris. The Sachet collections are deposited in the U. S. National Herbarium and in the National Museum at Paris. A set of Cyanophyta is in the herbarium of Francis Drouet who made the determinations at New Mexico Highlands University, Las Vegas, New Mexico.

## LIST OF SPECIES

### Chlorophyta

*Enteromorpha clathrata* (Roth) J. Ag. emend. Bliding 19966; 19960

*Ulva lobata* (Kütz.) Setch. & Gard. 19961; 19973; 19982; 20010

*Chaetomorpha antennina* (Bory) Kütz. 19977a

*Cladophora socialis* Kütz. ? 20003

*Cladophora perpusilla* Levring 20020a, sparse on *Chnoospora*

*Cladophora* sp. 19980a, in *Hypnea* turf

*Derbesia attenuata* Daws. 20008b

*Codium geppii* O. C. Schmidt, complex 19985

### Phaeophyta

*Ectocarpus irregularis* Kütz. ? 20020, sparse on *Chnoospora*

*Ectocarpus indicus* Sonder 19998; 20002b; 20008a; 20020c

*Sphacelaria furcigera* Kütz. 20002a

*Sphacelaria* sp. 20008

*Chnoospora implexa* Hering, ex J. Ag. 19953, scraps; 20002; 20013

*Dictyopteris repens* (Okam.) Børg. 19981; 19989; 19991; 19994; 19997; 20017

*Pocockiella variegata* (Lamx.) Papenf. 19954; 19977; 19984; 19986; 19988; 19995; 19996; 20007; 20011

### Rhodophyta

*Acrochaetium subseriatum* Børg. 20003c, on *Cladophora*; 20008d, rich and fertile

*Erythrotrichia carnea* (Dillw.) J. Ag. 20008c

*Porolithon oncodes* (Heydr.) Foslie 19983, ⊕; one living specimen, from 125 foot depth, and beach worn specimens "washed onto beach on all sides of island" collected by E. C. Allison.

*Porolithon marshallense* Taylor? Several cast, dead, beach-worn specimens collected by E. C. Allison.

*Fosliella paschalis* (Lemoine) Setch. & Gard. 20005, on *Chnoospora;* 20012, on *Chnoospora*, with bisporic conceptacles 100-110 $\mu$ in diam.

*Heteroderma minutula* Foslie 19980b, bisporic, on *Cladophora*

*Jania capillacea* Harv. 19952

*Jania tenella* Kütz. 19976; 19978, densely compact tufts with the branching in one plane somewhat obscured

*Jania longiarthra* Daws. 20019

*Hypnea spinella* (Ag.) Kütz. 19951; 19979; 19987; 19990; 19993; 20001; 20018

*Ceramium* sp. near *C. mazatlanense* Daws. 20020b, ⊕

*Polysiphonia mollis* Harv. 20016, ♂ and ⊕

*Polysiphonia subtilissima* Mont. 19999, in *Hypnea* turf. This, fide

Tseng 1944, is like some of the writer's material from Viêt Nam.

*Herposiphonia secunda* (Ag.) Ambron 20015

Cyanophyta

*Calothrix crustacea* Thur. 19968; 19970; 19971; Sachet 471

*Entophysalis deusta* (Menegh.) Dr. & Daily 19965; Sachet 305; 462; 471

*Hormothamnion enteromorphoides* Grun. 19970; 19971

*Hydrocoleum glutinosum* (Ag.) Gom. 19955; 19956; 19957; 19959; 19963; 19974

*Hydrocoleum lyngbyaceum* Kütz. 19955; 19956; 19959; 19963; 19968; 19970; 19971; 19972; 19975

*Hydrocoleum comoides* (Harv.) Gom. 19974; 19975; 20014

*Lyngbya confervoides* Ag. 20006

*Lyngbya rivulariarum* Gom. 19972, in old sheaths of *Hydrocoleum*?; 19975; Sachet 305

*Microcoleus chthonoplastes* (Fl. Dan.) Thur. Sachet 471

*Phormidium fragile* (Reinke) Gom. 19967

*Plectonema terebrans* Bron. & Flah. Sachet 462

*Schizothrix heufleri* Grun. Sachet 471

*Spirulina subsalsa* Oerst. 19963

*Spirulina tenerrima* Kütz. 19964, in sheath of *Hydrocoleum;* 19974

## DISCUSSION

From these collections it seems clear that the flora is very limited in species and consists in large part throughout the seaward reef areas and down to at least 78 feet, of turfs of *Jania* and *Hypnea. Pocockiella* also is generally abundant, and *Ulva* conspicuous at least on the reef-flats. *Chnoospora implexa* is apparently the largest of the common forms. *Codium* may be locally conspicuous, but appears only once in the collections. Other than these, only a rather few small forms occur as turf mixtures or epiphytes, the most prominent of these being *Dictyopteris repens.* The samples of crustose coralline algae show that the principal algal reef-building element in the flora is probably *Porolithon oncodes,* and gives this widespread species a second known location in the Pacific eastward of the 110° meridian of west longitude.

The floral composition is almost entirely of species that are common and widely distributed throughout the Indo-Pacific region. The *Porolithon, Jania, Pocockiella, Herposiphonia* elements are particularly characteristic, but the very low degree of species diversity, even for Pacific atolls, is remarkable. Part of the apparent lack of species may be due to the relative inexperience of the collectors, but the collections are ample enough to have presented at least fragmentary evidence of other species had they been commonly present. The epiphytic elements are especially sparse, and admixtures in the *Hypnea* and *Jania* turfs are largely absent. The exceptional abundance of fertile *Hypnea spinella* in almost every sample indicates its dominance with *Jania* throughout the area. This is

unusual, for it has not often been reported for Pacific atolls. Indeed, it came to the writer's attention only recently and rather unexpectedly as a frequent species at Palmyra atoll in the Line Islands (Dawson 1959). Palmyra is another remote atoll of rather poorly diversified flora, but with its richly developed stands of *Turbinaria, Bryopsis, Avrainvillea. Halimeda,* etc., it is far more characteristic of Pacific atolls than Clipperton Island which, apparently, lacks all of these genera as well as such commonly conspicuous plants as *Dictyosphaeria, Boodlea, Gelidiopsis, Wurdemannia,* and *Centroceras* which one would expect to find.

A few samples of the algal flora of the lagoon were obtained by Miss Marie-Helene Sachet. The lagoon is now cut off from the sea, and, being constantly supplied with rain water, is essentially fresh. The following were collected:

*Lyngbya semiplena* (Ag.) J. Ag. and *L. aestuarii* (Mert.) Liebm. Sachet 478, on coral rock and gravel in the lagoon, N.E. part of the island, Aug. 24.

*Calothrix crustacea* Thur. Sachet 474, in sand and crust along lagoon edge, S.W. part of island, Aug. 19.

*Lyngbya confervoides* Ag. and *Amphithrix violacea* (Kütz.) Born. & Flah. Sachet 328, very abundant on coral rocks along lagoon edge. N.W. side of island, Aug. 17.

*Lyngbya guaymasensis* Dr., *L. semiplena* (Ag.) J. Ag., and some *Anacystis aeruginosa* (Zanard.) Dr. & Daily Sachet 325, concentrated near shore of lagoon after a strong wind, N.E. side of island, Aug. 15.

A few collections were made on the higher, terrestrial levels of the island. The most prominent algae on the open surfaces of the island as a whole are *Anacystis montana* (Lightf.) Dr. & Daily and *Scytonema hofmannii* Ag. which, usually in association, form a grey, film-like covering of coral and shell fragments everywhere (20009; Sachet 463; 466; 473).

Other terrestrial collections by Miss Sachet are:

*Protococcus grevillei* (Ag.) Crouan and *Plectonema nostocorum* Born. 476, on surface of sand turning to sandstone, slab near top of beach, N.E. coast of island, Aug. 23.

*Mastigocoleus testarum* Lagerh. and *Entophysalis deusta* (Menegh.) Dr. & Daily 475, surface of coral pebbles and consolidated coral rock. S.W. side of island near lagoon shore, Aug. 19.

*Calothrix crustacea* Thur. and primordia of green algae 472, surface of consolidated ledge, S.W. side of island, Aug. 19.

*Plectonema nostocorum* Born. and young *Nostoc* 467, on dead coconut trunks and husks, grove at base of Clipperton Rock, Aug. 12.

*Plectonema terebrans* Born. & Flah., *Mastigocoleus testarum* Lagerh., *Entophysalis deusta* (Menegh.) Dr. & Daily, and *Calothrix crustacea* Thur. 305; 308, forming thin layers or crusts on coral sand, N.E. coast of island, Aug. 10.

## Danger Islands

This small deep water collection of four species is our only representation of the algae of this island. A fairly rich flora may, however, be expected to occur and to resemble that reported by Setchell (1924) from Samoa.

In 1935, Børgesen described and illustrated an extremely large *Rhizoclonium* species from exposed littoral rocks at Bombay, India. This species, *Rhizoclonium grande*, was soon afterward found by Tseng (1936) in a similar habitat on the coast of Hainan, China. The following year, Setchell & Gardner (1937) described *Rhizoclonium robustum* from tide pools on North Seymore Island in the Galapagos Archipelago. The latter authors were apparently unaware of the work of Børgesen or of Tseng, for the descriptions and illustrations of all three are so similar that there is virtually no question but that the Bombay, Hainan and Galapagos plants represent a single species which should be called *Rhizoclonium grande* Børg. It is characterized by filaments mostly 350-400 $\mu$ in diameter, with frequent rhizodial branches and cells mostly 1-3 diameters long with very thick (35-40 $\mu$) prominently stratified walls.

Now we find in the tropical Pacific another large species of *Rhizoclonium* commonly exceeding 200 $\mu$ in diameter, but markedly unlike *R. grande* in the very thin cell walls (about 4-5 $\mu$) and in its habitat in deep, still waters. This species, although not so large in diameter as *R. grande*, is still considerably in excess of the next larger species in the genus, namely *R. hookeri* Kütz. and *R. rhizophilum* Taylor, both inhabiting *Rhizophora* roots and under 140 $\mu$ in diam. These several sharp distinctions justify description of the present plant as new.

**Rhizoclonium profundum** sp. nov. Fig. 1

Thalli filamentosi, laxe implicati, partibus in maturis plerumque 200-250 $\mu$ diam., cellulis 1½-2½ longioribus quam latis, ad septa paulum constrictis, membranis tenuibus (4-5 $\mu$), manifeste, autem, stratificatis; plantae iuveniles e organo affixionis parvo multicellulari, digitate ramoso orientes, 2-3 ramos iuxta basim habentes, in spatio unius centrimetri super basim a 70 ad 220 $\mu$ diam. expansae, rhizoidea unicellularia aut multicellularis frequentia efficientes; filamenta matura raro ramos, rhizoidea longa frequenter efficientia.

Thalli filamentous, loosely entangled, 4-9 cm. long or more, mostly 200-250 $\mu$ in diameter, of mature cells 1½-2½ diameters long, very slightly contracted at the septa, the walls thin (4-5 $\mu$), but clearly stratified; juvenile plants arising from a digitately branched, small, flat multicellular attachment, with two or three branches near the base, expanding from about 70 $\mu$ in diam. at the base to 220 $\mu$ diam. 1 cm. above the base, producing frequent unicellular or multicellular rhizoids, these usually forming attachment discs but occasionally forming new vegetative shoots from their tips; mature filaments rarely branched except

for short protuberances, but frequently producing long rhizoids.

TYPE: *Dawson 20022*, in Herb US (Isotype US), Pukapuka, Danger Islands, Union Group, col. by F. R. Sanderlin between Aug. 22 and Oct. 28, 1958, on IGY Solar Eclipse expedition.

This plant was found entwined about luxuriant specimens of *Caulerpa urvilleana* Mont. which were said to be growing in a fine coral ooze at depths between 150 and 225 feet and not observed either at shallower or deeper levels. The only other species detected in this association were small or fragmentary *Cladophora* and *Lejolisia* epiphytes.

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